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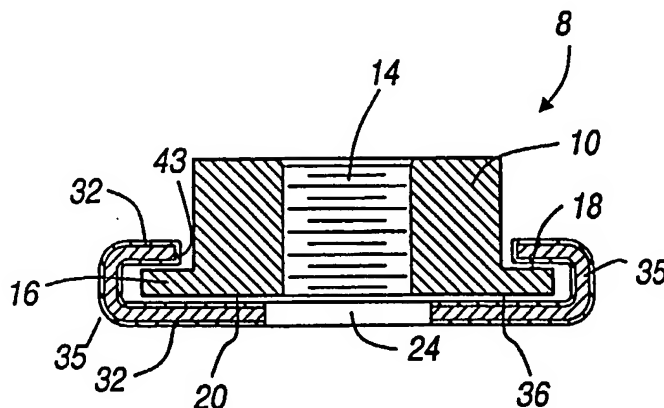
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(54) Title: FLOATING NUT CAGE FASTENER



(57) Abstract: A cage nut assembly is disclosed having a body defining a through bore. The cage is disposed about at least a portion of the body which has at least one surface having a lower wetability than the body to inhibit the formation of a coating bridge between the body and the cage.

WO 03/042557 A1

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FLOATING NUT CAGE FASTENER

FIELD OF THE INVENTION

[0001] The present invention relates to an encaged threaded
5 fastener, and, more particularly, to an encaged fastener which minimizes
problems of adhesion of the threaded fastener to the cage by application of
paint or other coatings.

BACKGROUND OF THE INVENTION

10 [0002] With ever increasing design demands, flexibility and
adaptivity of unibody construction is increasingly required in order to provide
vehicles that meet broader customer needs. Increases in the number of
components and structures which are coupled to the unibody construction
have led designers to consistently add threaded fasteners to the unibody
15 frame. Variation in manufacturing tolerances require that the fastener couple
to the unibody frame in a way which allows a degree of positional adjustment
during final assembly. This positional adjustment is provided by using a
female fastener which is an encaged fastener. Typically, this takes the form
of a nut encaged in a structure that is attached to the inner body frame. The
20 cage is configured so as to provide the nut with a range of movement so that
when a component is coupled to the frame, the alignment of the component
and frame can be adjusted until they meet manufacturing standards.

[0003] Prior to coupling of the components to the frame, however,
the frames typically are painted or coated using e-coat processes. To date,
25 the step of painting the frame often will cause the fastener to adhere to the
cage. This prevents the fastener from being adjustable within the cage and,
therefore, causes tolerance problems in the final assembly of the product. To
prevent the tolerance problems, post-process inspection after painting is
required to ensure that the fasteners are not adhered to the cage. Should the
30 fastener be adhered to the cage by coating, post-process rework must be
conducted to free the fastener.

SUMMARY OF THE INVENTION

[0004] Accordingly, this invention provides a cage nut fastener which is weldable to a substructure that overcomes the problems and disadvantages of the cage nuts of the prior art. Briefly, the invention includes
5 a threaded fastener; a fastener cage capable of fastening the fastener to a substructure, the cage having a coating which inhibits coatings from sticking to the cage.

[0005] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should
10 be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

15 BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The greatest advantage of the present invention will become apparent to one skilled in the art upon reading the following specification and by reference to the drawings in which:

[0007] FIG. 1 is a perspective view of the cage nut fastener in its
20 unassembled condition;

[0008] FIG. 2 is a perspective view of the cage nut of the present invention in its assembled configuration; and

[0009] FIG. 3 is a cross-section of the cage nut in FIG. 2 showing the relationship of the coating with respect to the fastener and the cage.
25

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

30 [0011] With reference to FIGS. 1-3, a cage nut fastener, shown generally at 8, has a body 16 coupled to a planar base 12. The body 16 and planar base 12 define a threaded through bore 14. Planar base 12 has an upper base surface 18 and lower base surface 20. The cage nut assembly 8

further has a cage 22 which is generally disposed about the planar base 12. The cage 22 has a cage upper surface 34 and cage lower surface 32. Additionally, the cage 22 defines two pair of flanges 28. The flanges 28 define cutouts 26 which generally correspond to the shape of the body 16.

5 **[0012]** As can be best seen in FIG. 2, the flange elements 28 are folded to enclose the planar base 12 of the body 16. The flanges 28 are positioned so as to restrict the movement away from the cage 22 of the body 16. Additionally, the cutouts 26 are positioned so as to restrict the planar movement of the body 16 within the assembly.

10 **[0013]** The cage 22 is configured so the body 16 has a limited range of movement. As can be seen in FIGS. 2 and 3, the cage allows slight movement away from the cage upper surface 34 as well as allowing planar movement generally parallel to the cage upper surface 34. This planar movement is generally restricted and defined by the space between the
15 cutouts and the body 16.

[0014] As best seen in FIG. 3, the cage 22 has a coating layer 35 disposed on a surface which directly faces the hexagonal body 16 or planar base 12. This coating provides a surface that has a low wettability, and preferably has a lower wettability than the body 16. This significantly reduces
20 the amount of wetting of any coatings subsequently sprayed onto the as coated cage 22.

[0015] It is preferred that the coating 35 be applied at a weight of 2 to 9 mg/sq. ft. and preferably at 3 to 5 mg/sq. ft. and have a dynamic coefficient of friction of less than about 0.3 and, more preferably, less than
25 0.2. The coating can be selected from the group of hexavalent and trivalent chromium with phosphoric acid passivation treatment (available as Permatrete 2510 from Betz Laboratories), a mixture including paraffin wax (122-130°F melting point) and a blend of a non-ionic surfactant (HLB 4.7) and nonionic surfactant (HLB 14.9) available as Trisco Tex CN from Scholler Inc.
30 of Philadelphia, PA, a mixture including paraffin wax (131°F melting point) and a blend of a nonionic surfactant (HLB 4.7) and a nonionic surfactant (HLB 14.9), a mixture including paraffin wax (130-135°F melting point) and a blend of a nonionic surfactant (HLB 4.7) and a nonionic surfactant (HLB 14.9), a

mixture including paraffin wax (140-145°F melting point) and a blend of a nonionic surfactant (HLB 4.7) and a nonionic surfactant (HLB 14.9) a mixture including paraffin wax (160-165°F melting point) and a blend of a nonionic surfactant (HLB 4.7) and a nonionic surfactant (HLB 14.9) or mixtures thereof.

- 5 Alternatively, the coating can be a fluoropolymer such as PTEF, an e-coat layer, or DC-9870 from BetzDearborn.

[0016] The coating 35 functions to prevent any additional e-coating or paint from sticking onto the cage 22. When the body 16 and planar base 12 are painted or coated, the coating 35 will stick onto the body 16, planar
10 base 12, and threaded through bore 14. The coating 35, however, provides a significant resistance to adhesion of the paint to the surface of the coating 35. This prevents a coating bridge from forming and allows the body 16 and planar base 12 to float freely within the cage 22. The coating can be adhered to just the upper surface 34 of the cage 22. Additionally, the coating can
15 cover the cage lower surface 32 and the surfaces of the cutouts 26.

[0017] The coated cage of the assembly of the present invention minimizes problems of paint adhesion by providing a surface which has a very low coefficient of friction, thus allowing drainage of the paint and minimizing contact between the body 16 and the cage 22. These improvements
20 significantly increase manufacturing speeds by reducing the amount of post-painting rework.

[0018] Optionally the cage and/or nut can be coated with non-stick coatings. Specifically, the cage or nut can be coated with an epoxy coating containing between about 5% to about 30% and preferably between 10% and
25 20% PTFE. The PTFE can be in a powder form. An example of this material is E-Coat Block produced by Environmental Protective Coatings of Ohio.

[0019] In this regard, it is specifically envisioned that the body 16, prior to forming of the cage nut assembly, can be coated with a mixture of about 10% to about 20% and preferably between about 12% and about 18%
30 and most preferably about 15% volatile solvents; and about 15% to about 35% and preferably between about 20% and about 30% and preferably about 26% epoxy; and between about 40% and about 60% and preferably about

26% to about 50% and most preferably between about 48% water and about 5% to about 15% and preferably about 9% ash.

[0020] The coating contains small amounts of amine material to facilitate cross-linking of the epoxy. An example of an epoxy that can be used
5 is Bisphenol epoxy. The ash can take the form of Ti or Fe materials.

[0021] The epoxy of the coating materials is held in suspension within the water and volatile solvents. It is believed the coating according to the present invention has a pigment to binder ratio below a point so as to form a resin-rich surface coating. This resin-rich coating is glossy so as to inhibit
10 any adhesion of the e-coat to the nut. Further, the resin-rich coating is weak and will fracture should a small e-coat bridge form.

[0022] In this regard, upon drying the volatile solvents and water are driven off leaving the body component 16 and planar base 12 having a coating of cross-linked epoxy, and ash. The body 16 and base 12 can be
15 coated with a material having between 50% and 90% epoxy and between 15% and 30% ash. As a specific example, the body 16 and base 12 can be coated with a layer having 75% epoxy, and 25% ash. This particular combination has been found to allow the coating on the nut to survive standard manufacturing environments prior to e-coat applications. It is further
20 thought that this percentage of ash material allows for the proper coefficient of expansion of the coating to allow proper adhesion of the coating to the nut.

[0023] Alternatively either the cage or the fastener can be coated with either Permatreat 2550, which contains trivalent chrome or Betz DC-1578A. It is envisioned that the cage 22 and the body 16 can be coated with
25 any of the aforementioned materials. Additionally, the body 16 can be coated with differing materials. As an example, the body 16 can be coated with E-COAT BLOCK while the cage 22 can be coated with Permatreat 2550. As the cage must be welded, it is preferable that the cage be conductive.

[0024] The description of the invention is merely exemplary in
30 nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A cage nut assembly comprising:
5 a body;
a cage disposed about at least a portion of said body, wherein the cage provides a limited range of movement of the body within the cage, said cage having a coating on at least one surface which has a low wettability.
- 10 2. The cage nut assembly in accordance with Claim 1, wherein the coating has a weight of 2 to 9 mg/sq. ft..
3. The cage nut assembly in accordance with Claim 1, wherein the coating has a weight of 3 to 5 mg/sq. ft..
- 15 4. The cage nut assembly in accordance with Claim 1, wherein the body comprises a planar base and wherein the cage defines a pair of flanges which cover at least a portion of the base, and wherein the coating is disposed between the flanges and the base.
- 20 5. A cage nut assembly comprising:
a body defining a threaded bore therethrough;
a cage disposed about at least a portion of said body, wherein the cage is configured to limit the range of motion of the body, said cage
25 having at least one surface coated with a layer comprising hexavalent and trivalent chromium with phosphoric acid passivation treatment.
6. The cage nut assembly in accordance with Claim 5 wherein the coating is selected from the group of hexavalent and trivalent chromium with phosphoric acid passivation treatment, a mixture including paraffin wax having
30 a melting point between about 122-130°F and a blend of a non-ionic surfactant (HLB 4.7) and nonionic surfactant (HLB 14.9), a mixture including paraffin wax with a melting point of 131°F and a blend of a nonionic surfactant

(HLB 4.7) and a nonionic surfactant (HLB 14.9), a mixture including paraffin wax having a melting point of between about 130-135°F and a blend of a nonionic surfactant (HLB 4.7) and a nonionic surfactant (HLB 14.9), a mixture including paraffin wax with a melting point of between about 140-145°F and a
5 blend of a nonionic surfactant (HLB 4.7) and a nonionic surfactant (HLB 14.9), a mixture including paraffin wax having a melting point of between about 160-165°F and a blend of a nonionic surfactant (HLB 4.7) and a nonionic surfactant (HLB 14.9) and mixtures thereof.

10 7. A cage fastener comprising:
a hexagonal body defining a threaded bore therethrough;
a cage having an upper surface and two pair of flanges bent to
enclose at least a portion of said body, said upper surface having a coating
with a coefficient of friction of less than 0.3.

15 8. The cage fastener of Claim 7 wherein said body is disposed on
said cage upper surface.

20 9. The cage fastener in accordance with Claim 7 wherein the cage
has a lower surface and said coating is further disposed on said lower
surface.

25 10. The cage fastener in accordance with Claim 7 wherein the
flange members are capable of engaging at least a portion of the body.

11. The cage fastener of Claim 7 wherein the body further
comprises a planar base having a bore defined therein.

30 12. The cage fastener of Claim 11 wherein the base is disposed on
the cage upper surface.

13. The cage fastener of Claim 7 wherein the coating has a
coefficient of friction of less than 0.2.

14. The cage fastener in accordance with Claim 7 wherein the coating comprises PTFE.

5 15. The cage fastener according to Claim 7 wherein the coating comprises hexavalent and trivalent chromium with a phosphoric and passivation treatment.

10 16. A cage fastener comprising:
a hexagonal body defining a threaded bore therethrough, said body having a coating with a coefficient of friction less than 0.3; and
a cage having an upper surface and two pair of flanges bent up to enclose at least a portion of said body.

15 17. The cage fastener according to Claim 16 wherein said coating comprises about 50% to about 75% volatile solvent; about 15% to 20% epoxy; about 5% to about 30% PTFE; and about 5% to 15% ash.

20 18. The cage fastener according to Claim 16 wherein the coating comprises between about 60% and about 70% volatile solvents; about 15% to 20% epoxy; about 5% to about 10% PTFE; and about 5% to 15% ash.

25 19. The cage fastener according to Claim 16 wherein the coating comprises about 15% volatile solvents; about 26% epoxy; about 48% water; and about 9% ash.

30 20. A cage fastener comprising a body defining a threaded bore therethrough, said body having an outer coating comprising:
50% to 90% epoxy;
between about 15% and 30% ash; and
a cage having an upper surface and a plurality of flanges bent to enclose at least a portion of said body.

21. A cage fastener according to Claim 20 wherein said coating comprises about 75% epoxy, and about 25% ash.

22. The cage fastener according to Claim 20 wherein the outer
5 coating comprises a resin-rich surface layer.

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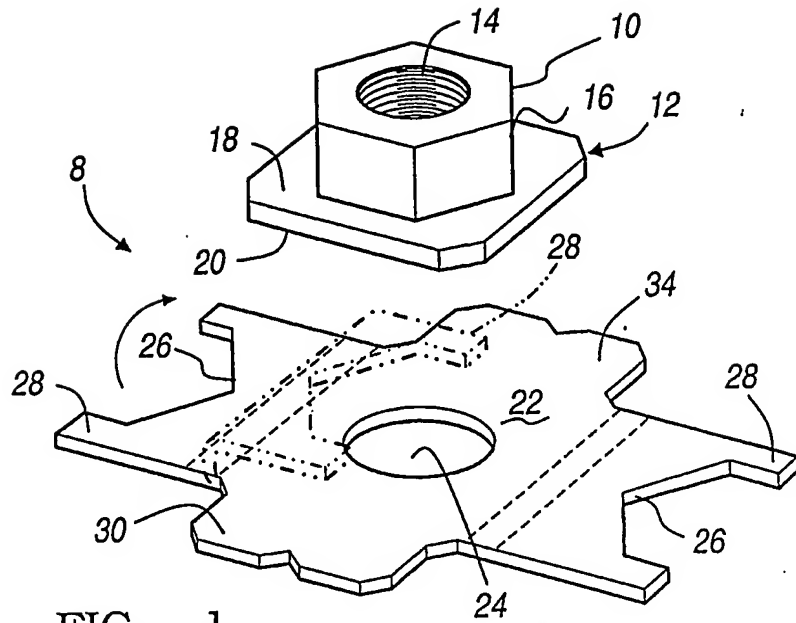


FIG.- 1

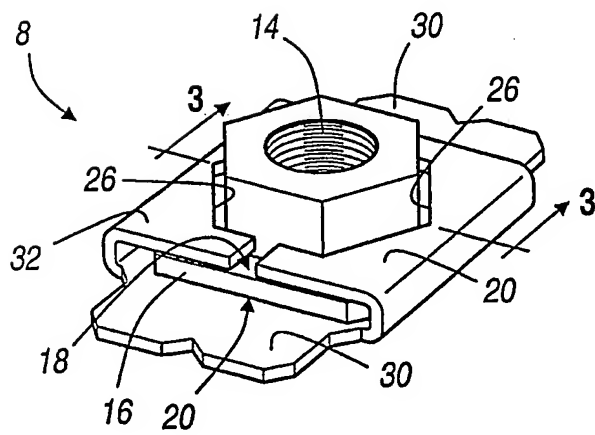


FIG.- 2

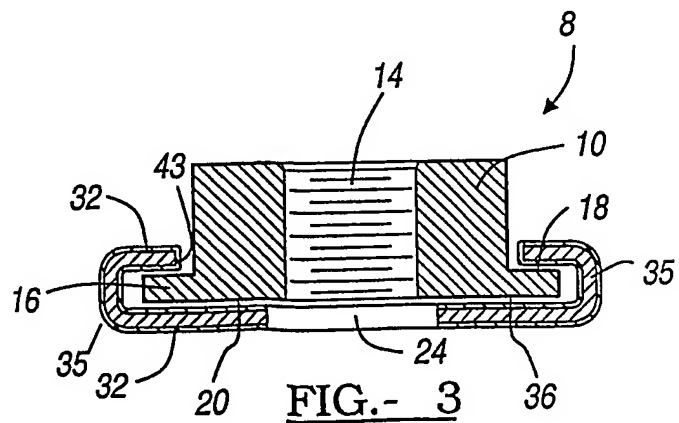


FIG.- 3

INTERNATIONAL SEARCH REPORT

Inter al Application No

PCT/US 02/34608

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 F16B37/04 F16B33/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F16B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 116 890 A (E & E MFG COMPANY INC) 18 July 2001 (2001-07-18)	1
A	the whole document	2-22
X	GB 2 041 138 A (CAMLOC FASTENER GMBH) 3 September 1980 (1980-09-03)	1
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A	EP 0 405 025 A (BUELL IND INC) 2 January 1991 (1991-01-02) the whole document	1-22

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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- *P* document published prior to the international filing date but later than the priority date claimed

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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 02/34608

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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